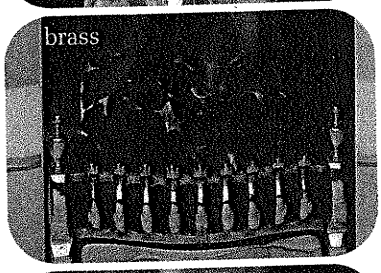
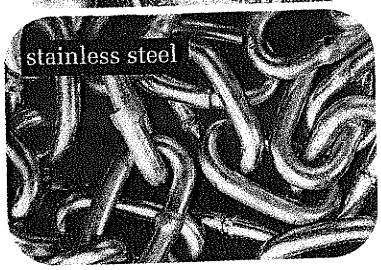
BIG IDEA

6.0 Mixtures of raw materials can be processed to make useful things.





These metals are called **alloys**. They are really solutions of two or more natural metals.

There are all sorts of manufactured products made from mixtures. You may be surprised to find out that some of these products have very different properties from the original **raw materials**. In the next section, you will find out about supercooled liquids that look like solids and about raw materials that, when combined, make some of the strongest materials in the world. You will also investigate some of the environmental problems that go with producing, using, and disposing of these products.

6.1 Products Manufactured from Mixtures

Explore

Thousands of years ago, people began to mix substances together to make more useful materials. Raw materials such as sand, soda, and limestone can be collected and processed to produce different materials, such as glass. Let's look at how some manufactured products are made from mixtures.

Develop

A Mix of Ingredients

Making Glass

You are surrounded by glass, from the bottles that contain your drinks to the windows that you look through. **Glass** is a unique material that looks like and behaves as a solid, but has many of the properties of a fluid. Scientists regard glass as a supercooled liquid. Glass is a manufactured material made by heating a mixture of substances that can include sand, carbonates, and limestone. Other substances can be added to give the glass colou or special qualities. Although these materials are plentiful and cheap, the energy needed to heat them is expensive.

Glass is made in a tank furnace. The raw materials—sand, carbonates, and limestone—are fed into one end and molten glass at 1000°C is produced at the other. This molten glass can be made into flat sheets, blown by automated machines into containers, or pressed into different shapes.

Glass is used to make containers, mirrors, and windows. It deteriorates only a little over time and doesn't contaminate its contents. Glass can even be spun into fibres, which are stronger than steel, and used in fibre optics to transmit light and information. Glass for bottles or windows is made of 75% sand, 15% carbonates, and 10% lime (from limestone). Recycled glass is sometimes added to help the melting process and may make up 50% of the total mixture.

Most glass containers are disposable—they are made to be thrown out. This creates an environmental problem because smashed pieces of glass are dangerous and glass does not break down easily. However, today, many towns and cities recycle glass to sell back to the manufacturers who use it to produce new glass.

*info*BIT

People have been making glass for over 6000 years. At first, highly coloured glass was used to glaze pottery for decoration. The Egyptians used glass for jewellery, and around 1500 BCE, they produced the first glass bottles. These bottles were used for holding perfume and oils.

Egyptian glass, 1500 BCE–1300 BCE

Making Steel

Steel is a very strong metal. It is used to make building materials, food cans, cutlery, and ocean liners. **Steel** is a mixture of iron (from iron ore), carbon, and small quantities of other substances.

How Steel is Made

1 Iron ore is mined from the ground.

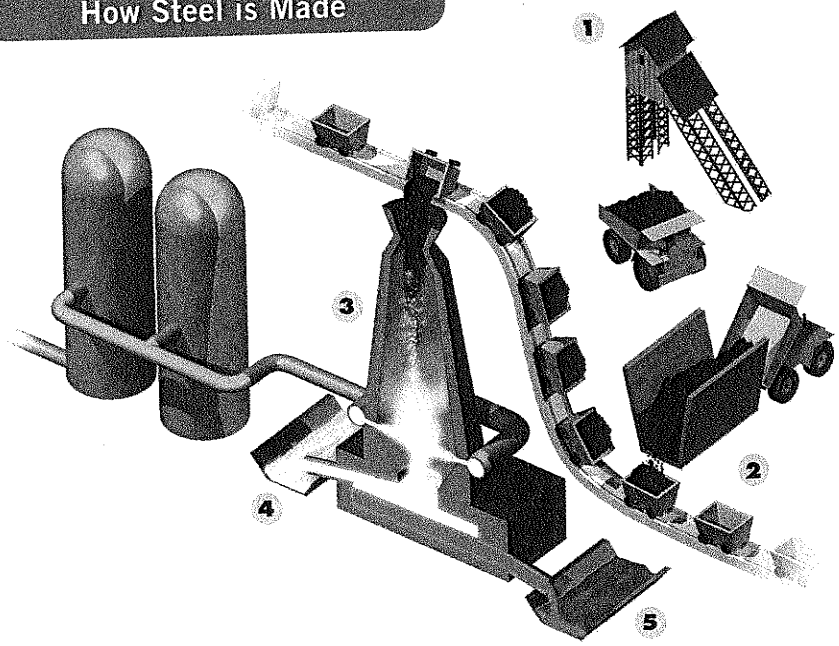
2 It is put into a blast furnace and mixed with limestone and coke (a type of coal).

3 At about 1650°C, the coke mixes with the iron ore to make liquid iron, called pig iron.

4 The limestone mixes with unwanted substances to make slag (waste matter).

5 The pig iron contains about 4% carbon.

The iron is processed to remove impurities to make steel (which should contain about 2% carbon or less).



Communicate

1 List three raw materials used to make glass.

2 What are three characteristics of glass that make it a useful mixture in our lives? Give an example of how one characteristic is used in a product.

3 What is the difference between pig iron and steel? Are both of these materials pure substances or mixtures? How do you know?

4 List at least two other mixtures that are made into manufactured products.

infoBIT

Regina, Saskatchewan, is home to a large steel-making plant that can produce over 900 000 t of steel each year. Its worldwide plants have the yearly capacity of nearly 4 000 000 t of steel. In the plant, scrap metal is melted at high temperatures and then converted to liquid steel. This steel is used to make products like oil pipeline and railway cars.

IPSCO (Interprovincial Steel Corporation) was founded in Regina in 1956 as the Prairie Pipe Manufacturing Company Ltd. It is now owned by Russian steel producer, Evraz.

6.2 Cleaning Our World

Explore

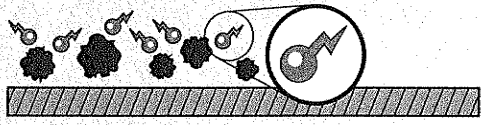
While you are eating a hamburger, a glob of grease falls and lands on your pants. You hope that laundry detergent will be able to get the grease stain out. But what is it about detergents that gives them their special cleaning powers?

A **detergent** is a substance that cleans away dirt. Most detergents are liquids or powders that can dissolve in water. **Soap** is a type of detergent. Generally, the word "detergent" refers to synthetic detergents, which have a different composition than soap. Detergents and soaps contain a cleaning agent called a surfactant. **Surfactants** are particles that attach themselves to dirt and oil particles, and pull them into the water to be rinsed away.

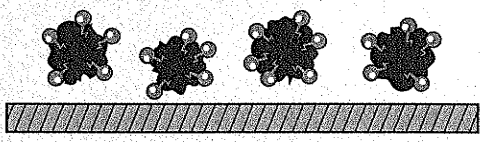
How Detergent Works

Dirt and grease on fabric

The mixture of water, detergent, and clothes is agitated in the washing machine. Dirt breaks off from the clothes.



Detergent surrounds the dirt particles so they can't reattach to clothes.



In the past, manufacturers added chemicals called phosphates to detergents. **Phosphates** increased the number of suds that the detergent produced and made the suds last longer. However, phosphates caused damage to the environment by polluting the water. Today, most detergents do not include phosphates.

Develop

What Cleans Best?

The best cleaners have the ability to dissolve dirt and grease. In the next activity, you will look at different solvents and their cleaning abilities.

INVESTIGATOR

Cleaning Solvents

The Question

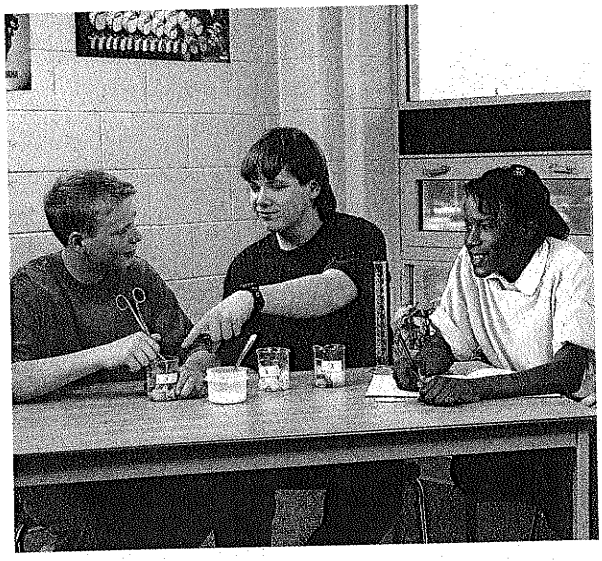
Can you remove stains from clothing using different solvents?

Materials & Equipment

- 3 250-mL beakers
- water (at room temperature)
- rubbing alcohol (at room temperature)
- vinegar (at room temperature)
- a graduated cylinder
- 3 identical pieces of fabric
- mud
- lipstick
- chocolate
- laundry detergent
- a pair of forceps or tweezers

Procedure

1. Pour 50 mL of water into one beaker, 50 mL of rubbing alcohol into another beaker, and 50 mL of vinegar into a third beaker. Label the beakers.
2. Mark each piece of fabric with equal amounts of mud, lipstick, and chocolate.
3. Place one piece of soiled fabric into each of the three beakers. Swirl the fabric around in each solvent using the forceps. Leave for at least 10 min. Look at the stains.
4. Add some laundry detergent to the beaker containing water. Use the forceps to move the fabric around in the solution.



Keeping Records

5. Make a table of your observations.

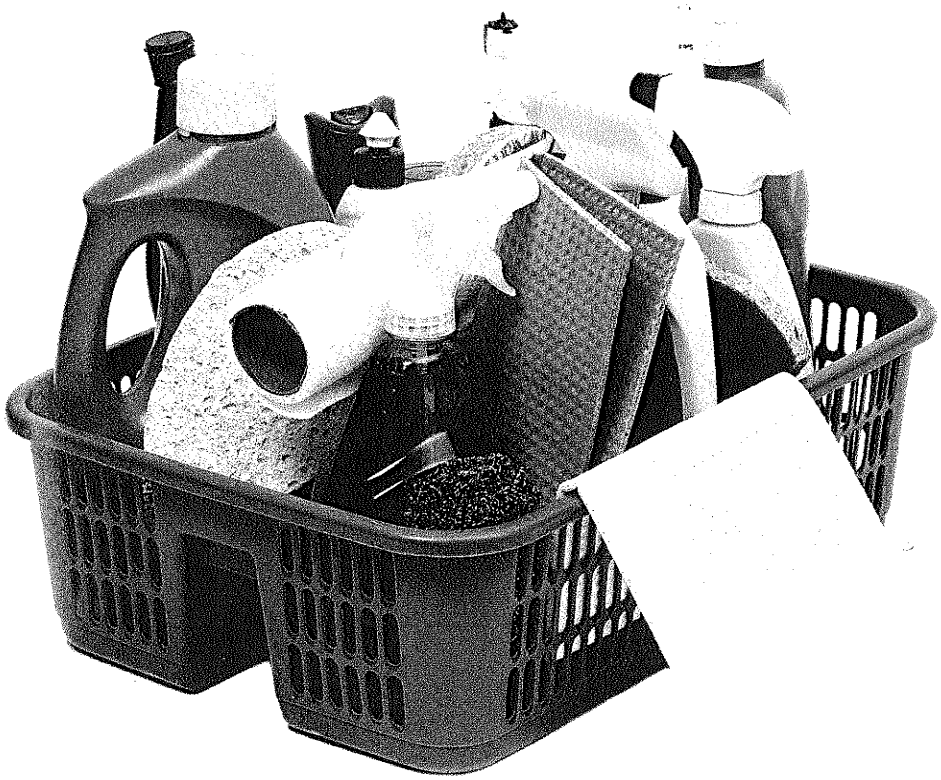
Analyzing and Interpreting

6. Did the mud dissolve in each solvent? Explain.
7. Did the lipstick dissolve in each solvent? Explain.
8. Did the chocolate dissolve in each solvent? Explain.
9. Did the detergent help the water dissolve the stains?

Forming Conclusions

10. Describe the results from your investigation and conclude which solvent did the best cleaning job for each type of stain and which was the worst. Support your conclusions with your data. Also, include one new thing you learned in this activity that you didn't know before.

When a substance is soluble in a solvent, it can be dissolved. Cleaning products are formulated to dissolve a variety of substances. These products dissolve the substances that cause stains so they can be removed from different surfaces.



Cleaning products come in a wide variety of shapes, colours, and uses. Many products now are "environmentally friendly."

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Ingredients in a typical laundry detergent

Ingredient	What it does	Ingredient	What it does
surfactant	cleans clothes	builder	softens water to help surfactant clean
filler	stops detergent from clumping	corrosion inhibitor	prevents washer from rusting
suspension agent	stops dirt from reattaching to material	enzyme	removes protein stains
bleach	removes stains	optical whitener	adds brightness
fragrance	adds scent	colouring agent	gives detergent colour

Non-toxic Cleaners

Cleaners that contain toxic or hazardous chemicals can be damaging to your skin, as well as to the environment. You can make cleaners using some common household ingredients. Are these natural cleaners as effective as cleaners that contain toxic or hazardous chemicals?

PROBLEM SOLVER

Homemade Cleaners

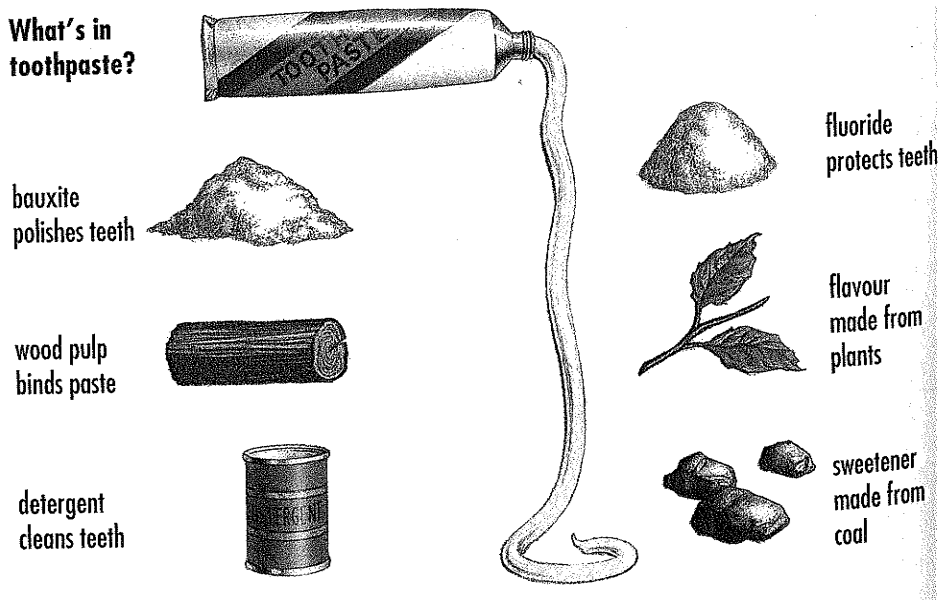
Make your own cleaners and test them against store brands. To make an all-purpose cleaner, mix 50 mL of baking soda, 125 mL of vinegar, and 4 L of water in a spray bottle.

- Decide what your cleaner will clean.
- Develop a plan to make a sample amount of your cleaner. Make a sample.

CAUTION!
Read the caution labels on the cleaners you use. It is dangerous to mix certain cleaners.

- What are some advantages and disadvantages of homemade cleaners?
- Create a fair test that investigates the differences between a homemade and a store-bought cleaner.

Long ago, people cleaned their teeth with a powder made from marble. Today, most toothpastes still contain powdered minerals, such as bauxite, as well as other substances. These substances include a binder made from wood pulp (to keep the paste mixed), a detergent (made from chemicals) to clean your teeth, fluoride (a chemical to help keep your teeth strong), colouring, and flavouring (made from plants such as mint).



Communicate

1 Describe one thing you learned about cleaners that you didn't know before.

2 Describe the results of the fair test you developed for the Problem Solver Homemade Cleaners. Which type of cleaner cleaned best?

3 The following statements were taken from advertisements for laundry detergents. What ingredients are being emphasized?
   a) "Now brighter and whiter than ever"
   b) "Cleans your washing machine as it cleans your clothes"
   c) "Removes the toughest stains"
   d) "Now in new ocean mist scent"

6.3 Waste and the Environment

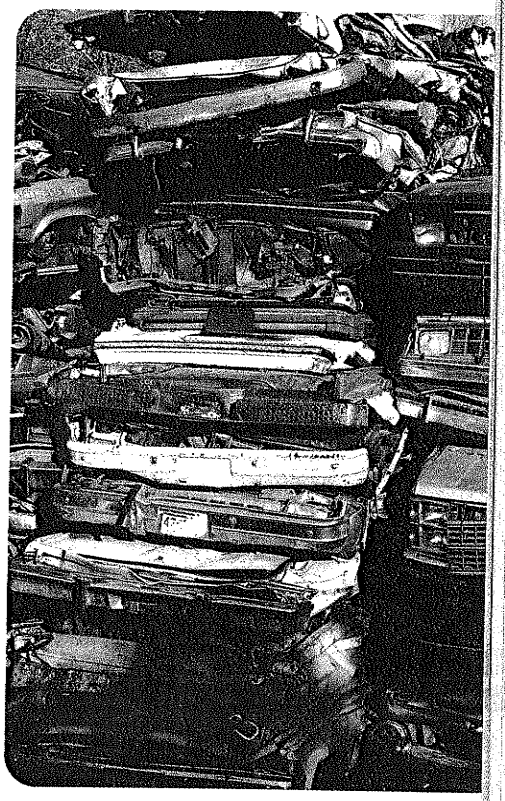
Explore

Nature is very good at reusing and recycling natural waste materials. Just think about what happens to fallen leaves and dead plants. Although people are very good at producing waste, they aren't as good at recycling it. Some forms of the waste humans produce can be used again, but most are dumped as garbage. Many of the substances that are thrown away as waste are not **biodegradable**. This means that they do not break down, as leaves and dead plants do.

Waste materials that are dumped and do not decompose can cause pollution. Other waste materials produce pollutants when they decompose. There are many sources of waste that affect the environment, including garbage, industrial waste, air pollution, agricultural waste, and sewage.

What do you think of when you hear the word pollution?

- List some environmental problems that concern you.
- Give some specific examples of how these problems affect your daily life.



These were once new cars!

Cleaning up an oil spill

Develop

Examining Different Types of Waste

People produce a variety of different types of waste: industrial waste, air pollution, agricultural waste, and sewage.

Industrial Waste

Industries are responsible for creating large amounts of waste. These industries include food processing, mining, petrochemical and plastic production, as well as the manufacture of consumer goods. Industries depend on raw materials, such as iron, water, and wood, to manufacture goods. The manufacturing processes produce waste products that may be toxic. Toxic wastes can harm the environment and people if not handled properly.

You have heard the saying, "Reduce, Reuse, Recycle." Many industries have taken this slogan to heart. They have worked to reduce the waste they produce by changing processes and reusing waste products. In addition, they have found markets for products once considered waste. One example of success in this area is the Saskatchewan company, SARCAN (see Unit 1, page 85). It currently recycles more than 1 000 000 beverage containers each day!

What are these bags waiting for? They are what's left over when PVC (polyvinyl chloride) material is incinerated. Every kilogram of incinerated PVC produces 2 to 3 times that amount of waste!

Hazardous wastes contain such chemicals as cyanide, asbestos, and mercury. By law, they must be recorded and taken to special treatment facilities. But some hazardous wastes are illegally dumped, ending up in landfill sites, lakes, or oceans.

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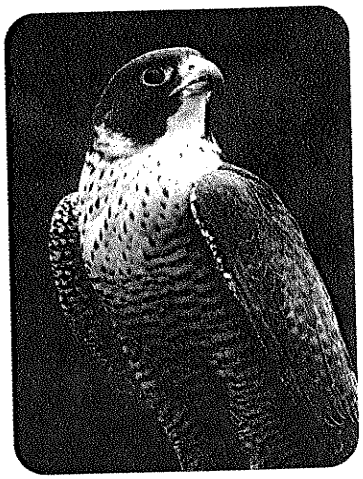
The peregrine falcon used to be a common sight throughout the Prairie provinces. The falcon almost became extinct in the 1950s and 1960s after consuming other birds contaminated with the pesticide, DDT. The Canadian government banned the use of DDT in the early 1970s.



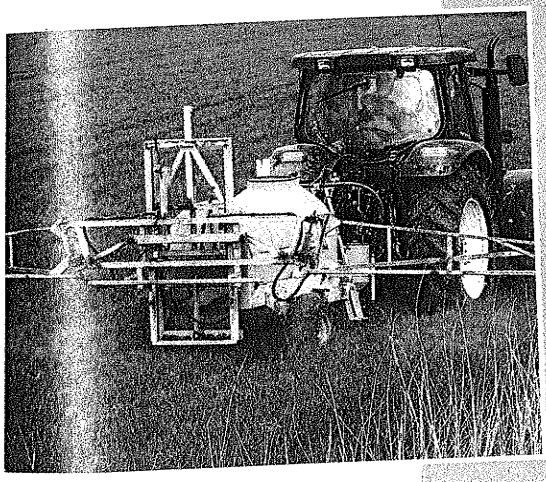
Air Pollution

During hot, hazy summer days, have you ever heard warnings about poor air quality? Many of the pollutants in the air come from the burning of fossil fuels (coal, gasoline). Air pollution can cause smog and acid rain.

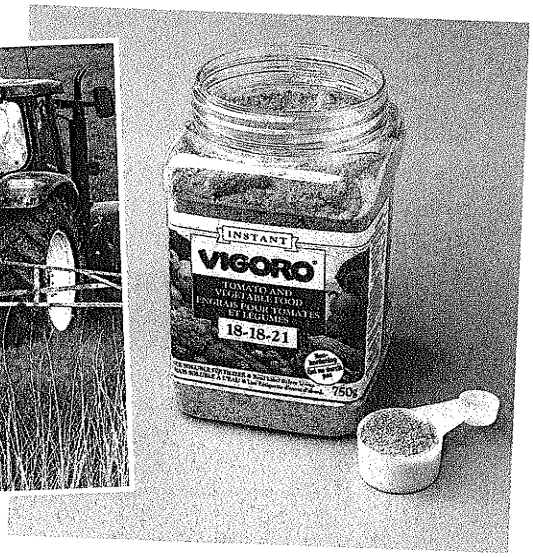
The major air pollutants are sulphur dioxide, nitrogen oxides, and carbon monoxide. Once in the atmosphere, sulphur and nitrogen oxides dissolve in water droplets to produce sulphuric acid and nitric acid. These acids fall to the ground in rain and snow. Acid rain changes the **pH** of water. But what does pH mean? Read the infoBIT to find out.

Agricultural Waste

Livestock on farms produce a lot of waste. Large amounts of manure cannot be recycled naturally, so the waste is kept in pits and later spread on the fields. However, if it is spread too thickly, the waste may be washed off into rivers and streams, causing water pollution.



Spraying a crop



Fertilizer for the home garden

Some farmers use pesticides and fertilizers containing nitrogen to make crops grow rapidly and to produce large harvests. These products are broken down by the soil to produce nitrates, which are used by plants. However, too much fertilizer produces too many nitrates, like manure, that can be washed away by rain into the groundwater or into rivers.

Too many nitrates in water cause plants and algae to grow uncontrollably. In time, these plants will choke out most other living things.

*info*BIT

The pH scale is a measure of how acidic or basic a solution is. The scale goes from 0 to 14. The difference between each number is equivalent to an increase of *ten times* the strength. (For example, a pH of 3.0 is ten times more acidic than a pH of 4.0.)

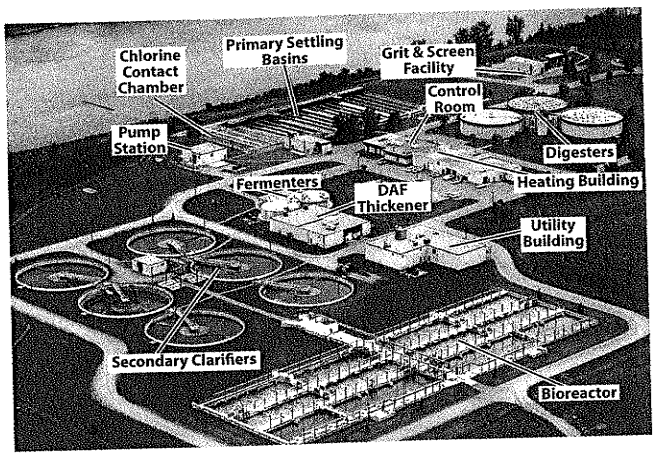
An acidic solution can have a pH between 0 and 6.

Orange juice can have a pH of around 3.7.

Water is usually considered to be neutral or to have a pH of about 7.0.

A basic solution has a pH between 8 and 14.

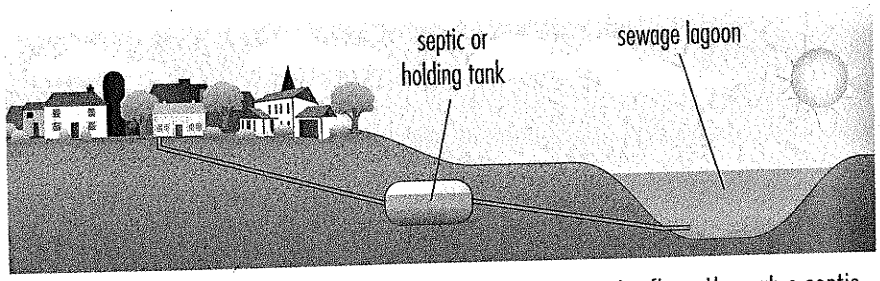
Chlorine bleach is near the end of the scale with a pH of 12.6.



Saskatoon Wastewater Treatment Plant has been in operation since 1971.

Sewage

Between 1832 and 1854, over 20 000 people in London, England, died from cholera. Cholera is caused by drinking water that contains sewage. **Sewage** is the waste that goes down the sink, the drain, and the toilet. In many areas of the province, sewage is collected in sewers and drains that lead to sewage lagoons. In larger communities, such as Regina and Saskatoon, sewage treatment plants collect and separate the wastes. The solids are processed to form sludge, which may be dumped in landfill sites or in the ocean (for coastal cities), or used to enrich soil for non-food crops. The cleaned water is returned to the environment.



In a well-designed sewage lagoon, there is no odour. Waste water flows through a septic or holding tank. There, organic material is broken down into scum and sludge. The treated liquid then flows into the bottom of the lagoon. Sunlight encourages the growth of algae in the lagoon, which produces oxygen through photosynthesis. The bacteria in the water use the oxygen to break down the remaining waste.

Good News

People have begun to realize how seriously any type of pollution can harm the environment. However, much is being done to clean up the effects of water pollution and other forms of pollution. Communities, provinces, and countries are working together to develop strict guidelines for the control of wastes. Industries are also becoming more environmentally responsible.

Communicate

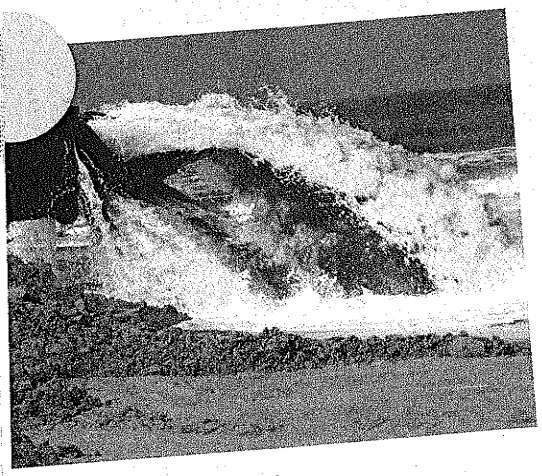
1. What are three waste threats to our environment?
2. There are many simple, practical ways you can help protect the environment. Find out what effect you and those around you have on the environment. Think about an environmental concern that you may have. Brainstorm ways in which you could make a difference to the problem you identified.

6.4 Check Your Progress

1. Choose a product you use. What substances do you think go into making it? Where would these substances come from?
2. What properties give detergents their ability to clean things?
3. How can a detergent clean grease off clothes?
4. If you had a beaker of water, a beaker of rubbing alcohol, and a beaker of vinegar, describe how you would construct a fair test to determine which liquid was the best cleaner.
5. What is the difference between toothpaste used in the past and toothpaste today? Were both types of toothpaste mixtures?
6. What are the different types of pollution and how do they impact our environment?
7. How can learning about pH help you understand acid rain?

Preserving and maintaining a healthy environment benefits all of us.

Sewage Treatment: A Mix of Solutions



No treatment

Every community produces a great amount of sewage. This is a mixture of all sorts of "nasty" stuff: human waste, bits of food, toxic and non-toxic chemicals, and just plain dirt. But one part of the mixture is very valuable—it's the water!

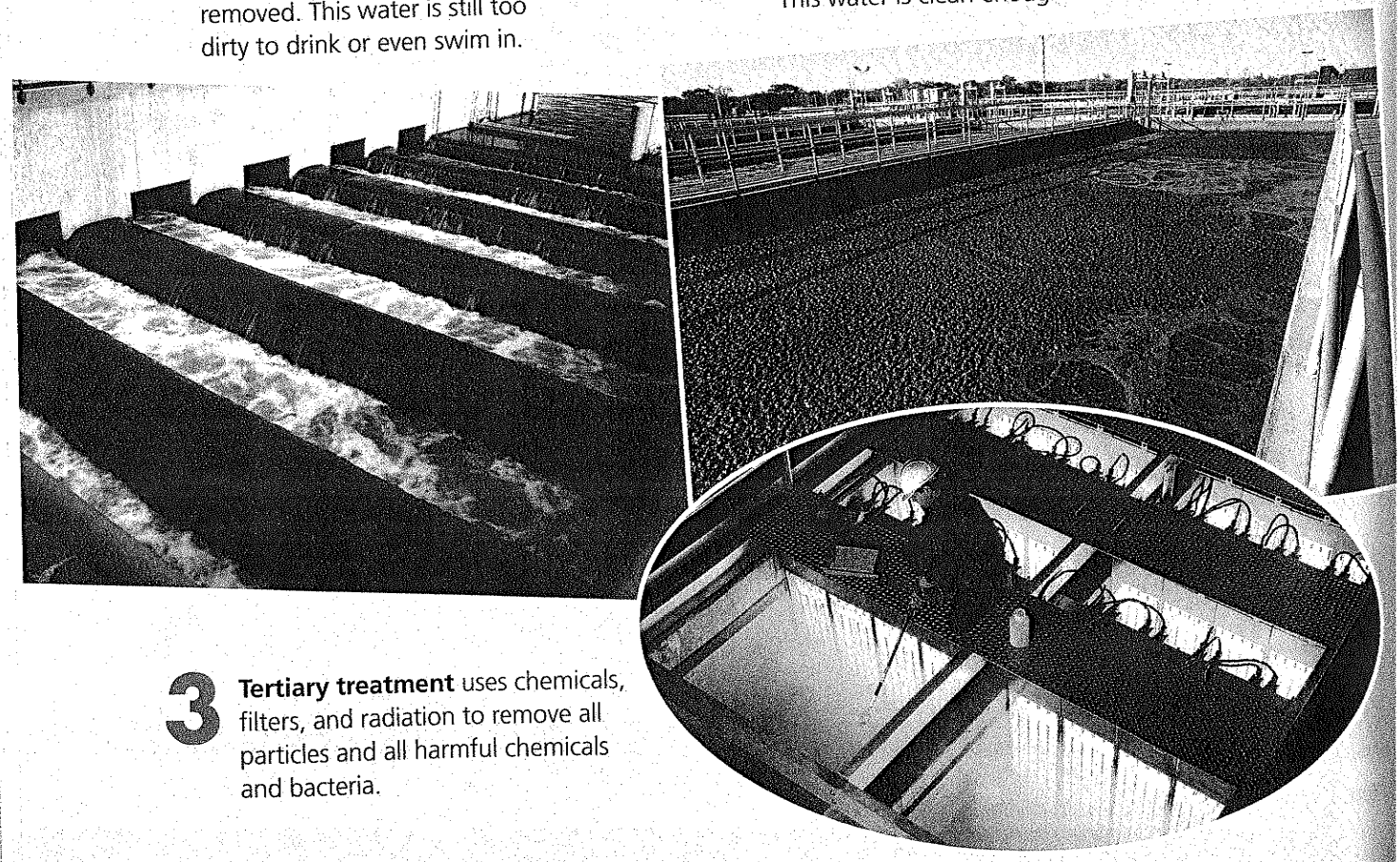
There is only a certain amount of water on Earth. As you know, it moves in what is called the water cycle (see Unit 1, Interactions within Ecosystems, page 43). Unfortunately, as people use water during this cycle, they also pollute it. Water is polluted by sewage, by industrial chemicals, and by pesticides from farms.

- What can we do to clean the water we've polluted?
- How can we separate the water from the rest of the mixture?

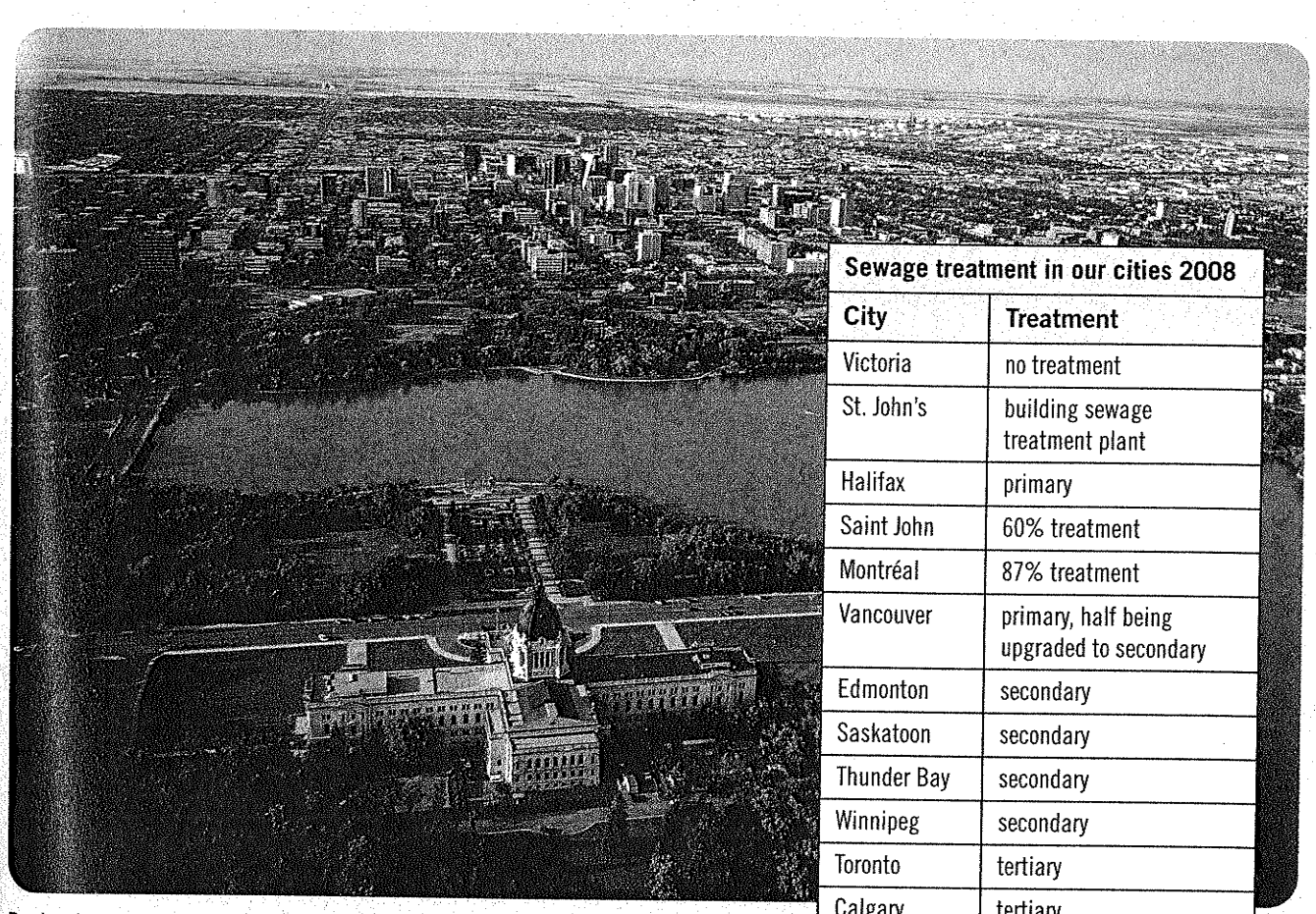
There are three levels of sewage treatment that large communities use: primary treatment, secondary treatment, and tertiary treatment.

1 **Primary treatment** removes large chunks of waste, dirt, and grease. Only 60% of dirt and particles are removed. This water is still too dirty to drink or even swim in.

2 **Secondary treatment** uses air and bacteria to break down sewage into less harmful materials. Ninety percent of dirt and particles are removed. This water is clean enough to swim in.



3 **Tertiary treatment** uses chemicals, filters, and radiation to remove all particles and all harmful chemicals and bacteria.



Regina has a tertiary sewage treatment plant.

Sewage treatment in our cities 2008	
City	**Treatment**
Victoria	no treatment
St. John's	building sewage treatment plant
Halifax	primary
Saint John	60% treatment
Montréal	87% treatment
Vancouver	primary, half being upgraded to secondary
Edmonton	secondary
Saskatoon	secondary
Thunder Bay	secondary
Winnipeg	secondary
Toronto	tertiary
Calgary	tertiary
Regina	tertiary

In Your Opinion

1 Work in a group of four to develop reasons supporting each of the following options. (Each group member chooses a different option.)

Four sewage-treatment options	
a)	no treatment
b)	primary treatment
c)	secondary treatment
d)	tertiary treatment

2 Share your points of view with other members of the class. (All the people supporting "no treatment" share viewpoints, all the people supporting "primary treatment" share viewpoints, and so on.)

3 Create a presentation to convince the other members of the class that this option is the best.

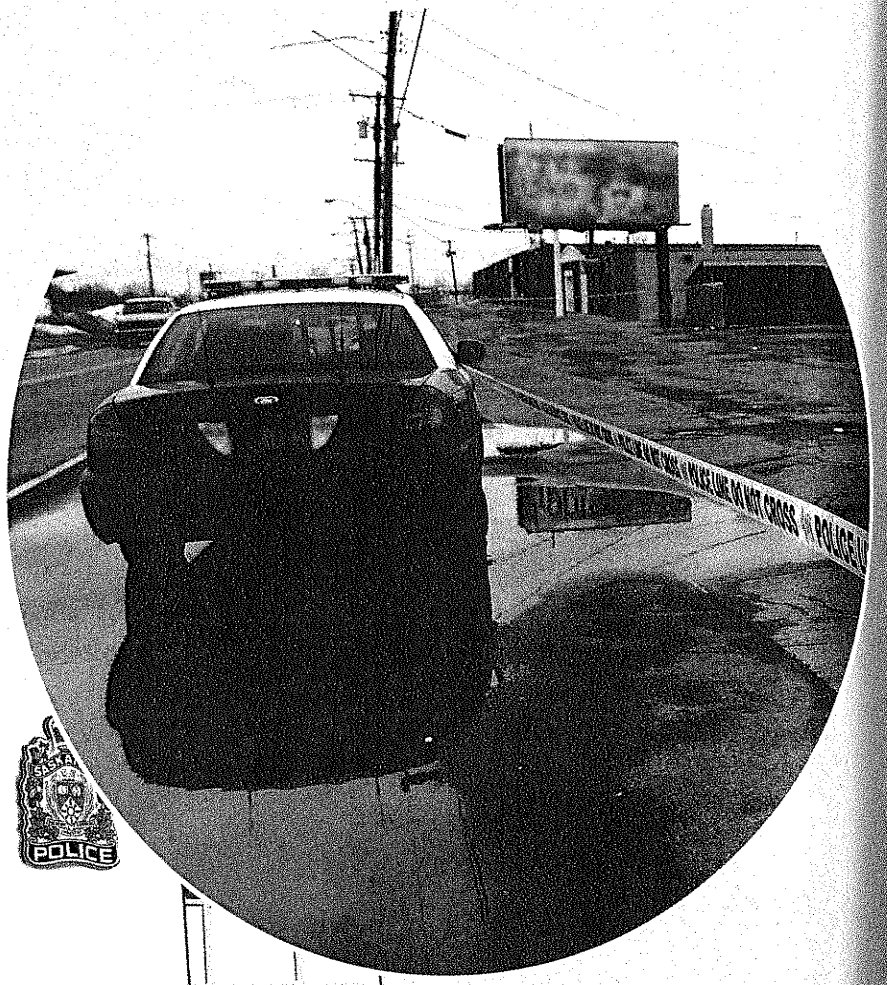
4 As a class, discuss why communities must often compromise on which sewage-treatment method they will use.

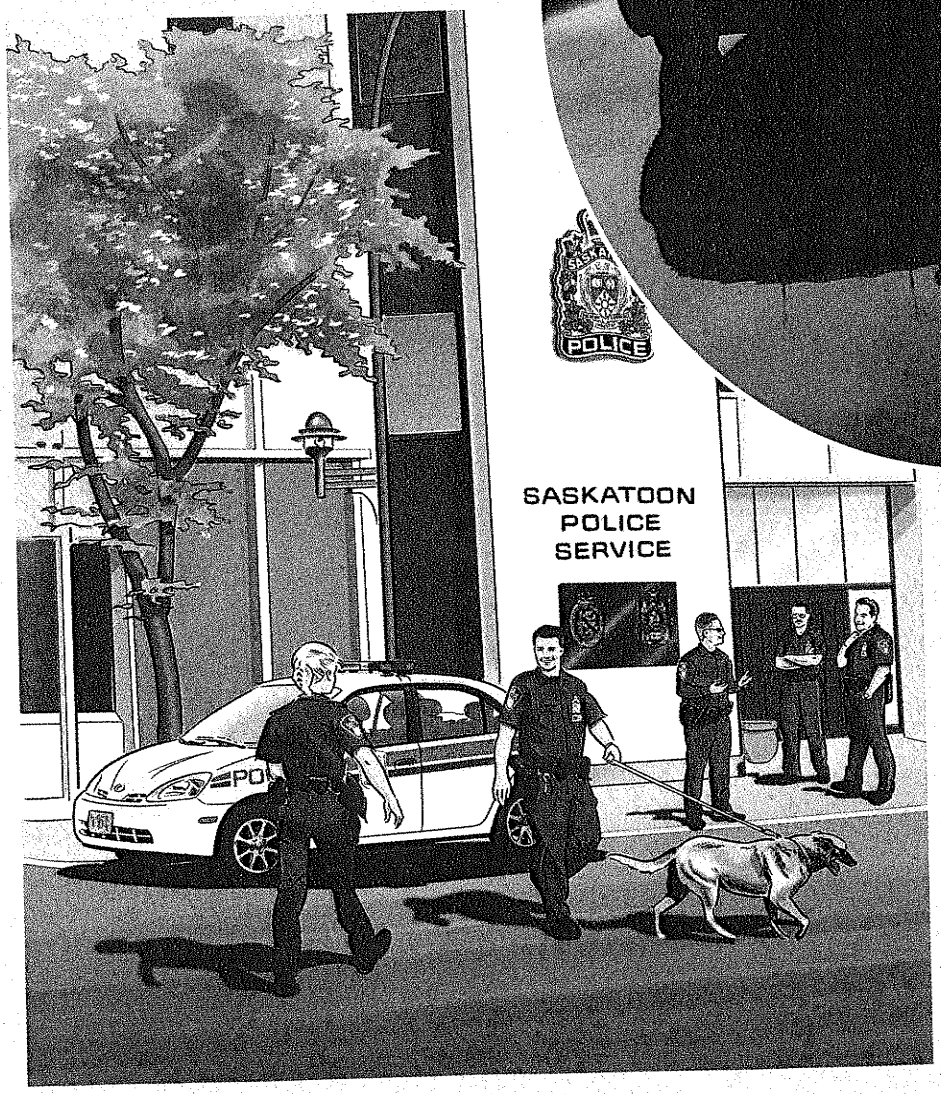
Project

What's Really in There?

Getting Started

During this unit you have developed a variety of skills. These skills include how to measure volume and mass, how to use a range of techniques to separate and identify mixtures, and how to apply your understanding of matter to explain a variety of natural phenomena.





Before You Start . . .

List and describe the different techniques you have used to separate both mechanical mixtures and solutions. Afterwards, take a moment with your partner or other classmates to look over the Crime Stoppers' Report Sheet on the next page.

Crime Stoppers' Report Sheet

Monday, 6:06 a.m.

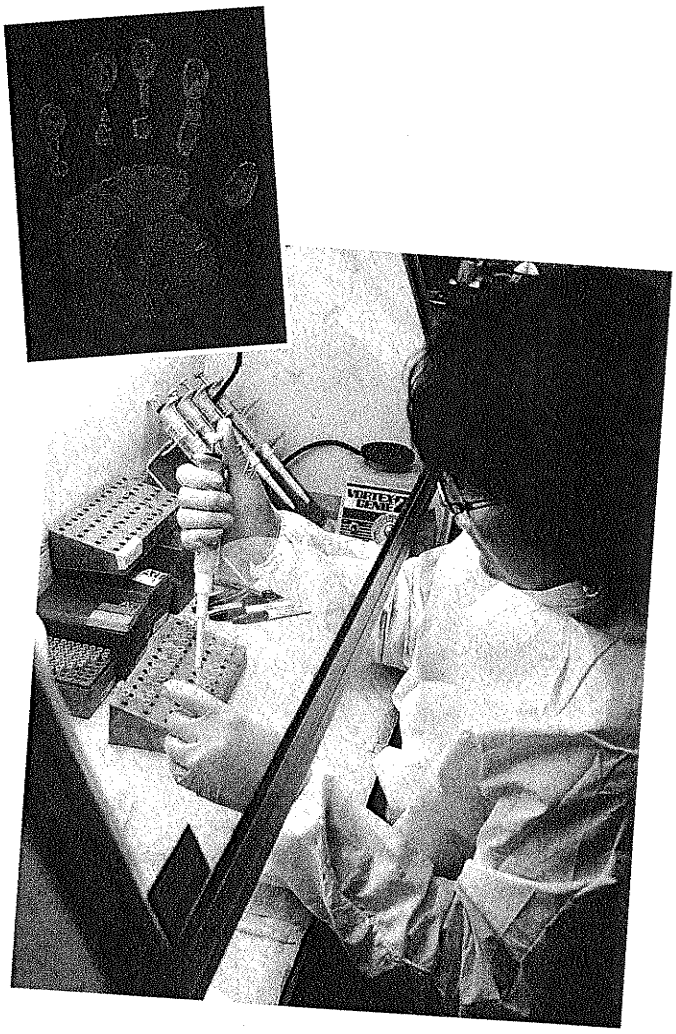
Passersby think they notice rain coming in a side door at Prairie Auto Glass, off Main Street. However, it is raining too hard, so they don't stop to investigate. They do call their concerns in to Crime Stoppers, who call the security company that patrols that area.

Monday, 6:14 a.m.

Allied Security arrives and discovers the glass window in the side door has been removed. They call police and the owners of Prairie Auto Glass. Allied Security discovers a number of computers have been taken.

Monday, 6:23 a.m.

The owners and police arrive at about the same time. Besides the computer equipment, several sheets of auto glass and at least 20 tires have been stolen.



Forensic analysts identify unknown materials by performing a series of tests. This process is called *qualitative analysis*. By following an identification procedure, analysts can eventually identify unknown materials. In many criminal investigations, the information collected is very useful in solving a crime.

ust the Facts

Vhen the police begin their investigation, ıey are baffled. The rain coming into the ıissing window has soaked the area, making : difficult to discover any clues. The police o check to see if the break-in method of ɜmoving the glass from the door has been sed in other recent robberies. It hasn't.

The forensic analysis team arrives next. 's their job to collect evidence using a ariety of scientific techniques. Lasers re often used to find fingerprints.

Specially made chemical sprays are also employed to find small amounts of residue left behind by the thieves. Tiny amounts of unknown material are collected and taken back to the forensic lab to be identified.

continued →

Investigators arriving at a crime scene.

During this unit you have developed the necessary skills to perform a qualitative analysis of an unknown mixture just as forensic analysts do. You will use the list of techniques you developed with your classmates as your guide to determining what substances are in the unknown mixture you receive from your teacher.

The Task

To identify all the substances in an unknown mixture using the proper techniques.

Materials & Equipment

- You will need to use a variety of equipment from your previous investigations. Your teacher will help you to organize your equipment, so everyone in the class has access to it.

Procedure

1. Review your list of techniques used to separate mixtures. Make any necessary revisions to your list before you begin the investigation.
2. Create a table that will allow you to record the results of each test you will perform.
3. Collect the sample of the unknown mixture from your teacher.
4. Using your list, perform an analysis of your unknown material to identify the substances present.
5. Record your results in a table.

Observations and Reflections

6. Summarize your results by describing what substances you think are in your mixture. Be prepared to defend your conclusions using your results.
7. How do you think you did in the investigation? Give yourself a rating on each of the following statements.

Statement	*	**	***
I used the proper techniques in this investigation.			
I remembered to follow the proper safety rules.			
My results reflect my effort.			
I worked well with others.			

* OK, but I could have done better.

** I worked well and am pleased with my effort.

*** I worked as hard as I could and am pleased with my effort.

Share and Compare

8. Share your results with other members of your class.

UNIT SUMMARY

1.0 The amount of matter is measured in two ways: volume and mass.

KEY CONCEPTS

- adding substances and mixtures to liquids
- measuring volume
- measuring mass

SUMMARY

- Some solids seem to disappear when mixed in a liquid. Some solids remain visible when mixed with liquids.
- A graduated cylinder is used to measure the volume of a liquid.
- The curved surface of a liquid in a cylinder is called the meniscus.
- All objects contain matter and are said to have mass.
- A triple beam or an electronic balance can be used to measure the mass of an object.

2.0 Mixtures can be classified into two types: mechanical mixtures and solutions.

KEY CONCEPTS

- the characteristics of matter
- examples of mechanical mixtures
- solutions

SUMMARY

- A pure substance has only one kind of matter.
- The Periodic Table of the Elements lists all the known elements. Elements are pure substances. When two or more elements are chemically combined, the substance is called a compound.
- A mixture is a combination of different substances. There are mechanical mixtures (also called heterogeneous mixtures) and solutions (or homogeneous mixtures).
- Scientists can explain the tanning process, but they do not explain the relationship between the tanner and the animal that gave its hide.
- Traditional Aboriginal ways of measuring volume and mass are learned first-hand. They are not written down as are scientific instructions.
- Solutions are created when two or more substances are mixed together and the result looks like one substance.
- A solvent is a substance in a solution that does the dissolving. A solute is the substance in a solution that is dissolved.

3.0 Components of mechanical mixtures and solutions can be separated.

KEY CONCEPTS

- separating mechanical mixtures
- separating solutions

SUMMARY

- Mixtures can be separated by colour, size, magnetism, and filtration.
- Solutions can be separated by boiling, using a centrifuge, and distillation.

continued →

UNIT SUMMARY (continued)

4.0 Scientists understand that all matter is made up of tiny particles.

KEY CONCEPTS

- the makeup of matter
- the Particle Theory of Matter
- dissolving

SUMMARY

- Matter can be in the form of solids, liquids, and gases.
- The four parts of the Particle Theory of Matter are:
  (1) All matter is made up of tiny particles.
  (2) The tiny particles are always moving and vibrating.
  (3) The particles are attracted or bonded to each other.
  (4) The particles have spaces between them.
- The Particle Theory explains the process of dissolving, which occurs when a solid substance seems to disappear when added to a liquid.

5.0 Solutions vary and can be described in a variety of ways.

KEY CONCEPTS

- types of solutions
- solubility

SUMMARY

- A concentrated solution contains a large amount of solute in a solvent. A dilute solution contains a small amount of solute in a solvent.
- An unsaturated solution still has room for more solute to dissolve. In a saturated solution, no more solute can be dissolved.
- Factors that affect solubility are temperature, type of solvent, and type of solute.
- Supersaturated solutions have more solute than would normally be able to be dissolved at a certain temperature.
- Hard water contains lots of dissolved minerals. Soft water has few dissolved minerals.

6.0 Mixtures of raw materials can be processed to make useful things.

KEY CONCEPTS

- products manufactured from mixtures
- products that clean
- waste products and the environment

SUMMARY

- Glass and steel are two common products that are made from mixtures.
- Cleaning products are designed to separate substances in mixtures and solutions.
- Products that break down into simple substances are called biodegradable.
- Industrial waste, air pollutants, agricultural waste, and sewage contribute to environmental pollution.

UNIT REVIEW

Using Key Terms

1 Write a sentence that defines each of the terms below:

pure substance
mechanical mixture
homogeneous mixture
heterogeneous mixture
solution
dilute
concentrated
Particle Theory of Matter
solvent
solute
solubility
saturated
unsaturated

Reviewing the Big Ideas

2 Why is it important to measure substances accurately in the lab?

3 You see the following safety symbol on a substance. What does it mean?

4 Name five important safety rules. Explain why you should follow these rules.

5 Why is it hard to tell whether a substance is a solution or a pure substance?

6 How can you distinguish solutions from pure substances?

7 What is a heterogeneous mixture?

8 Name five heterogeneous mixtures you can see from where you are working.

9 What kind of mixtures can be separated using filtration? Why?

10 What kind of mixtures can be separated by distillation? Why?

11 How is distilled water made? Is distilled water pure in the scientific meaning of the word?

12 Draw a particle picture of a mechanical mixture.

13 What does a solution look like?

14 What factors affect the rate of dissolving?

15 Can a dilute solution be saturated? Can a concentrated solution be unsaturated?

16 Why is the statement "Water is the solvent in any solution" not always true? Give two examples to support your answer.

17 Think of some situations where it is important to know the concentration of a solution.

18 Explain the difference between hard and soft water.

19 Give two examples of some manufactured products made from mixtures. What are their functions?

20 Describe two ways for treating sewage waste water.

continued →

Connecting the Big Ideas

21 Use the Particle Theory to explain how sugar dissolves in water.

22 Explain a mechanical mixture using the Particle Theory.

23 What type of mixture is each of the following?
a) orange juice
b) a brass button
c) milk
d) salad dressing
e) vinegar

24 Is stirring necessary for dissolving a solute? Explain why or why not.

25 The First Nations and Métis four elements are earth, fire, water, and wind. They are alive with spirit. However, the elements in the scientific periodic table are not alive with spirit. Give one example of a mixture or solution that might be understood as being "alive with spirit."

26 What two factors can you think of that would have little or no effect on the rate of dissolving? Why would they have no effect?

27 Why do some solutes dissolve in a particular solvent, while other solutes do not dissolve?

28 Have you ever heard a noise when you opened a cold bottle of soda pop? When you open a warm bottle of soda pop, the noise is much louder. What does this tell you about the relationship between the amount of carbon dioxide that dissolves in water and the temperature of the water?

29 Soda pop contains carbon dioxide. Why does a glass of soda pop go flat as it warms up?

30 Could you use soap to turn hard water into soft water?

31 Explain how laundry detergent removes a grease spot from material.

Using the Big Ideas

32 Which solution is more concentrated: 50 g of a substance in 200 mL of water or 10 g of the same substance in 40 mL of water? Explain. Calculate the concentration of each solution in g/100 mL of solvent.

33 The solubility of a substance at 20°C is 40 g/100 mL of water. A solution contains 30 g of solute dissolved in 100 mL of water. Is this solution saturated, unsaturated, or dilute? Explain.

34 How is salt removed from sea water to make drinking water?

35 How does the filter in a vacuum cleaner work?

Self Assessment

36 Look back in your notes and identify one piece of work that you are most proud of, one piece of work you could improve on if you were to do the assignment again, and one assignment where you learned something you didn't know before. For each piece of work, describe your thoughts in a short paragraph.